$$p_1 = p_2 = P \text{ (atmospheric pressure)},$$

$v_1 \doteq 0$, $v_2 = V$ (constant speed through tube), and applying Bernoulli's principle

$$P + h_1 dg = P + h_2 dg + \tfrac{1}{2} dV^2,$$

whence

$$V^2 = 2g(h_1 - h_2) = 2g\overline{DA},$$

which expresses a simple interchange of potential and kinetic energy, corresponding strictly with the facts upon the assumption that the operation is frictionless.

It will be easy to express the reduced pressure at the level A, inside the tube, by comparing two points at level A, one outside, the other inside

We have, outside

$$p_1 = P \quad v_1 \doteq 0,$$

inside

$$h_1' = h_1 \quad v_1' = V,$$

and thus

$$p_1' + h_1' dg + \tfrac{1}{2} dV^2 = P + h_1 dg,$$

$$p_1' = P - \tfrac{1}{2} dV^2,$$

but

$$\tfrac{1}{2} dV^2 = dg(h_1 - h_2);$$

therefore

$$p_1' = P - dg(h_1 - h_2).$$

We can now discuss the invariable refrain or *coda* found in all the type treatments. It appears to be based upon the assumption that a liquid can not exist with a negative pressure, or as sometimes expressed, under tension. This is hardly true; there is considerable experimental evidence to the contrary. Let us make this assumption, however, and limit the working height of the siphon to that which makes the pressure zero at the highest point.

Comparing points C (at level B) and D we have

At C

$$p_0 = 0, \; v_0 = V.$$

At D

$$p_2 = P, \; v_2 = V.$$

$$h_0 d\, g + \tfrac{1}{2} dV^2 = P + h_2 dg + \tfrac{1}{2} dV^2;$$

whence

$$(h_0 - h_2) dg = P.$$

Now $h_0 - h_2$ is the difference in level between D and B, which is thus shown to equal the barometric height for the given liquid, in the assumed limiting case. The ordinary statement asserts that AB equals the barometric height in the limiting case, the loss of pressure at A inside the tube being overlooked, and the concept being hydrostatic rather than hydrokinetic.

This discussion is not original in substance; see some good treatises on hydrodynamics.

HAROLD C. BARKER

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION E—GEOLOGY AND GEOGRAPHY

THE seventy-second meeting of Section E (Geology and Geography) of the American Association for the Advancement of Science was held in the Soldan High School building in St. Louis, Mo., on December 30 and 31. In the absence of Professor Charles Kenneth Leith, the vice-president elect of Section E, Dr. David White, chief geologist of the U. S. Geological Survey, was voted chairman for the St. Louis meeting, and presided.

The address of the retiring vice-president, Dr. David White, upon the subject, "Geology as Taught in the United States," was given on the morning of December 31 in the main auditorium, before a joint session of the Association of American Geographers, the American Meteorological Society, and Section E. This address will be printed in full in SCIENCE.

The vice-president of Section E for the coming year will be elected by the executive committee at its meeting in April. Dr. Nevin M. Fenneman, of the University of Cincinnati, was elected member of the council.

The program which was so full that each session overran the allotted time, comprised the following papers:

The origin of glauconite: W. A. TARR. Glauconite is a hydrous silicate of iron and potash. The composition is variable, but the amount of potash rarely exceeds 8 per cent. The mineral is amorphous, and is usually some shade of green. It occurs as rounded grains and irregular areas in dolomites, limestones, conglomerates, marls, sandstones and shales. It is found in the Cambrian formations of Missouri, Oklahoma, Texas, South Dakota and Wyoming, and in the Cretaceous and Eocene formations along the Atlantic and Gulf coasts. Geographically and geologically, glauconite is associated with granites, usually being deposited

after a period of base leveling, when weathering had been proceeding a long time. This long-continued weathering is thought to have furnished colloidal silica, iron, potash and alumina to the sea water, where through the action of the saline matter in the sea water the silica and alumina were precipitated, while the iron was thrown down by oxidation. These colloids mingled in varying amounts and then absorbed the potash from the sea water, thus forming glauconite.

A Mauch Chunk Island in the Mississippian Seas of eastern Kentucky: Willard R. Jillson, state geologist of Kentucky, Frankfort, Kentucky. In the eastern Kentucky coal fields on the divide between the Licking River and the Levisa Fork of the Big Sandy River, there exists an elongated structurally elevated area of between 700 and 1,000 square miles. This structural high has been called the Paint Creek uplift and is located so as to overlap parts of Magoffin, Morgan, Elliott, Lawrence, Johnson and Floyd counties. The Paint Creek uplift has a slight east of north major axis as mapped structurally on the Pottsville Fire-Clay coal. The normal dip at the surface is slightly to the south of east. The Paint Creek uplift culminates in two pinnacles, the Paint Creek Dome and the Laurel Creek Dome. There exists a maximum reversal of about 250 feet. The considerable amount of oil and gas prospecting drilling on these structures during the past two years has resulted in defining two pronounced oil and gas fields, one on either dome. Production is secured principally from the Weir sand which correlates with the Cuyahoga sandstone in the Waverley group toward the base of the Mississippian system. An examination of the well records of recent drillings in this locality shows an increasing interval between the Fire Clay coal of the Pottsville and the Big Lime (St. Genevieve-St. Louis) of the Mississippian, as one proceeds away from the highest structural points.

A summary conception of the structure of the Weir sand shows it to be much more steeply tilted than the persistent coals of the surface Pottsville. The absence of expected thicknesses of the Mauch Chunk on the top of this structure and the thickness of the Pottsville and Mauch Chunk on the sides coupled with the steeper inclinations of the Weir sands suggests an anticlinal island in the Mississippian seas at this point during the latter part of the Mauch Chunk period with unconsolidated Mauch Chunk sediments, subjected to subaerial erosion. Following early Pottsville times, quiescent subsidence is conceived to have taken place, which was followed during the time of the Appalachian overthrusts by folding and faulting along, and transverse to, the major axis of the original Mississippian anticline.

A Geological Section from St. Louis to Kansas City: E. B. Branson.

The Pre-Moenkopi unconformity of the Colorado plateau: C. L. Dake. The area over which the unconformity was studied embraces the region from the Zuni uplift in New Mexico west to the Little Colorado River in Arizona, and northwest to the vicinity of the Henry Mountains in Utah. Sudden changes in the thickness of the Moenkopi amounting to two hundred feet or more, in short distances, show local erosion of at least that magnitude during the pre-Moenkopi erosion interval. Data gathered by the writer tend strongly to confirm a hypothesis advanced by Cross that the Permian rests on progressively younger beds as the unconformity is traced westwards, the erosion amounting perhaps to all the Kaibab, the Coconino and the Supai formations. In other words the Moenkopi Red beds rest on the Kaibab formation in the area about the Grand Canyon and probably west of the Henry Mountains, while farther east they rest on the Goodridge (correlated by Girty with the Redwall) in the San Juan region, and probably on equivalent beds near Moab. This would involve the erosion of approximately two thousand feet of Pennsylvanian strata in the eastern portion of the area under discussion, the equivalents of which are present farther west. This conclusion, if true, would place the pre-Moenkopi unconformity among those of larger significance in geologic history.

Notes on the geology of the Cove areas of east Tennesese: C. H. Gordon, University of Tennessee, Knoxville. Within the western foothills of the Unaka or Great Smoky Mountains in east Tennessee are a number of irregular open valleys known locally as "coves." The largest of these is Tuckeleeche Cove on Little River. Wear Cove to the northeast and Cades Cove on the southwest are about half as large. The coves are underlaid by the Knox dolomite uplifted in broad irregular domes with the overlying Wilhite slates outcropping in broad irregular bands around them. The more fertile soils of the coves early attracted settlers and each is now the locus of a prosperous settlement. This and the region to the southwest is the typical region of Safford's Ocoee rocks consisting of sandstones, conglomerates and slates

more or less metamorphosed. These rocks were placed by Safford in the Cambrian a reference at first questioned by the government geologists but afterwards accepted. In this area the Ocoee slates overlie the Knox dolomite the larger part of which is Ordovician. These relations indicate, therefore, the presence here of a great overthrust fault whereby the lower Ocoee rocks have been thrust over the Knox dolomite to the distance of eight or ten miles. Two periods of faulting are recognized in the region, the first of which is recorded in the above-mentioned overthrust of the Cambrian upon the Knox. Later came another stage of folding and faulting in which the faults of the first period were involved giving rise to complex structures not always easily decipherable. It was during this second period of movement that most of the great faults of the valley were produced.

The Oriskany sandstone faunule at Oriskany Falls, New York: HARRY N. EATON. The type locality of the Oriskany sandstone is at Oriskany Falls, in the southern part of Oneida county, New York, where a lower Devonian section is exposed. This occurrence has been known in the literature since 1839 when Vanuxem noted it in his state survey report. Structurally, the sandstone is a small lens, ten feet thick, whose southern edge only can be observed. The faunal list is interesting chiefly because it is larger than formerly supposed, and as showing relations to other faunules in New York and Ontario. This study was incidental to more detailed work on the Oriskany in another New York locality.

Salem limestone outliers in central Missouri: COURTNEY WERNER.

Geology of the Sullivan county, Indiana, oil field: STEPHEN S. VISHER. Approximately 30 miles south of Terre Haute, and only a few miles from the Illinois boundary, there are seven producing oil pools aggregating in area about 12 square miles. About 500 wells are being pumped. The daily production was recently about 1,000 barrels. No report on the geological conditions in this oil field has been published. A study carried on recently under the direction of State Geologist Logan, has revealed several interesting facts. Production is from four sands. The highest of these, at a depth of approximately 620 feet, seems clearly to be along the unconformity between the Allegheny and the Pottsville divisions of the Pennsylvania Formation. The three lower sands are in the Mansfield division of the Pottsville. The second sand is about 660 feet below the surface; the third about 740 and the fourth about 800 feet. The presence of more than one oil sand has not been recognized by most drillers. Many wells have been abandoned only a few feet above a sand in which wells not far away obtain profitable production. No proof of local folding or doming was obtained. The evidence at hand indicates that the oil pools are lenses of sand along the buried valley of an ancient aggrading river or rivers. The Indiana Geological Survey is publishing the full report.

The late Pleistocene submergence in the Columbia River valley: J. HARLEN BRETZ.

The latest glacial features in the United States: HERMAN L. FAIRCHILD. These features are depicted on maps of a forthcoming Bulletin of the New York State Museum, proofs of which are here exhibited. The locality is the north boundary of New York. Here, on the point of the northern salient of the Adirondack mass the waning Quebec (Labradorian) glacier made its last stand on American territory with the effect of impounding glacial waters. Probably the ice sheet abandoned northern Maine somewhat later. The extinction features of Lake Iroquois, the last and most interesting of the long series of glacial waters, lie here; these being the second outlet channel through Covey pass and the shoreline phenomena on the west. On the Champlain side of the highland are the remarkable denuded rock areas and channels produced by the latest glacial drainage held to high levels by the Champlain lobe of the wasting glacier. Beneath these glacial stream features on the east side of the salient, and the Iroquois shore on the west side, lies the shore of the sea-level waters, which had followed the receding ice front up the Hudson-Champlain valley. This "marine" shore, strongly marked by heavy cobble bars and deltas, curves around the north end of the salient (Covey Hill) and passes back into New York north of Chateaugay village. At Covey pass the Iroquois plane is to-day 1,030 feet altitude, and the marine beach is 740 feet. The difference, 290 feet, is the altitude of Lake Iroquois at the time of its down-draining into the Champlain Sea, which figure is the master key to the quantitative study of land deformation in the Ontario-St. Lawrence valley.

Springfield, Missouri and the frontier of 1820: LEWIS F. THOMAS. About 1820 white settlers began to move into the Osage county of Missouri and settle in the more favored localities. One of these was the site of Springfield, which on account of a favorable combination of natural advantages out-

stripped all the other settlements. An abundant supply of sparkling water and a magnificent stand of walnut and oak timber determined the location of the cabins and stores. The near by grass lands were easily broken by the plow into fertile fields or left as open range lands for cattle. The greatest advantage was the location of the settlement, situated as it was on the broad undulating surface of the White-Osage River divide where an old north-south Indian trail intersected an east-west White River trail. These trails passed through the stages of road and pike to railroad. Back and forth over them moved the settlers and freight which gave life to the city and made it the social, political, manufacturing and commercial center of southwestern Missouri. Thus Springfield has been from the beginning of settlement a densely settled population outlier in the sparcely settled Ozark region.

The Chester series in Illinois: Stuart Weller. The original section of the Mississippian formation is that along the Mississippi River in Iowa and Illinois. The upper portion of this section constituting the "Chester Group" of Worthen is typically exposed in southern Illinois. This succession of strata is now considered to be of *Series* rank, and the upper Mississippian is now called the Chester Series, while the name Iowa Series is suggested for the lower Mississippian. In the course of detailed mapping in southern Illinois, in progress since 1911, the Chester Series has been subdivided into sixteen distinct formational units. In the more complete section, as exhibited in Pope and Johnson counties, these formations are alternately sandstone and calcareous members, the calcareous members being made up of considerable amounts of shale interbedded with limestone. The names used for these formations are as follows: *Upper Chester*—16, Kinkaid limestone; 15, Degonia sandstone; 14, Clore limestone; 13, Palestine sandstone; 12, Menard limestone; 11, Waltersburg sandstone; 10, Vienna limestone; 9, Tar Springs sandstone. *Middle Chester*—8, Glen Dean limestone; 7, Hardensburg sandstone; 6, Golconda limestone; 5, Cypress sandstone. *Lower Chester*—4, Paint Creek limestone; 3, Yankeetown formation and Bethel sandstone; 2, Renault limestone; 1, Aux Vases sandstone. The limestone members of this series of formations, with the possible exception of the Vienna, exhibit a continuous distribution across the state from Hardin county at the southeast to Randolph and Monroe counties at the northwest, but most of the sandstones are not continuously present. The Aux Vases sandstone has its greater development in the Mississippi River section and thins out to the southeast, being very certainly wanting in the section east of Union county. The Bethel, Cypress, Hardensburg and Tar Springs sandstones have their great development in the southeast and are either wanting in the Mississippi River section, or are represented by more or less discontinuous, thin beds. The Waltersburg sandstone has its great development in Pope and Johnson counties and thins out both to the east and the west. The Palestine and Degonia sandstones are about equally developed across the entire Chester area in the state.

Correlation of the Upper Paleozoic rocks of the Hueco Mountain region of Texas: J. W. Beede.[1] Three great groups of rocks, the Mississippian, Pennsylvanian and Permian, each separated from the beds beneath them by unconformity, are represented in the Hueco region of Hudspeth county, Texas. The Mississippian is composed of some 500 feet of limestones and shales, and is referred to the Chester Group by Weller. Eleven hundred feet of Magdalena beds composed of limestones and marls represent the Des Moines Group of the Pennsylvanian system. The Manzano Group corresponds to the Wichita beds of central Texas and the Neva limestone to Summer Series of Kansas. The Abo sandstone of New Mexico appears to be wanting at localities studied; but belongs to Upper Pennsylvanian system. These beds are followed by strong unconformity carrying 100 feet of foreign conglomerate which cuts diagonally across the upper beds and the Diablo plateau to the northern Salt Flat. It is followed by part of the Leonard formation and farther south the Word formation comes in. This unconformity appears to be the one at the base of the Leonard formation in the Glass Mountains which extends from Salt Flat southwest to the Hueco and southeast to the Glass Mountains. From there northeastward to eastern Coke county and Red River, and probably into Kansas. It is the surface on which the Double Mountain beds were deposited.

The Devonian rocks of southwestern Illinois: T. E. Savage. The Devonian rocks in the lower Mississippian embayment have an aggregate thickness of nearly 1,000 feet. Of these, a thickness of more than 800 feet occur in southwest Illinois. In this state these rocks do not extend as far north as St. Louis, and their outcrops are restricted to

[1] Published by permission of the director of the Bureau of Economic Geology and Technology, University of Texas.

a belt a few miles wide near the Mississippi River. In this succession of strata all of the series, or larger divisions, of the Devonian system recognized in the New York section are present, as shown in the following table of formations:

Devonian formations present in southwest Illinois:

Upper Devonian.
  Chautauquan series.
    Mountain Glen shale, 45 feet.
  Senecan series.
    Alto formation, 90 feet.
Middle Devonian.
  Erian series.
    Lingle limestone, 90 feet.
    Misenheimer shale, 35 feet.
  Ulsterian series.
    Grand Tower limestone, 125 feet.
    Dutch Creek sandstone, 30 feet.
    Clear Creek chert, 300 feet.
Lower Devonian.
  Oriskanian series.
    Rocks of this age are not known to occur in the state, but they are present farther northwest in Missouri; and farther southeast, in western Tennessee. Remnants are probably present in Illinois, but concealed beneath younger strata.
  Helderbergian series.
    Back-bone limestone, 65 feet.
    Bailey limestone, 100 feet.

ROLLIN T. CHAMBERLIN,
Secretary

(*To be continued*)

THE AMERICAN GEOPHYSICAL UNION

THE first annual meeting of the American Geophysical Union was held in the forenoon of April 23, 1920, at the offices of the National Research Council in Washington. At this meeting the permanent organization of this body was completed, amendments to its statutes were adopted, by-laws were enacted, officers of the Union were elected and the elections of officers of the sections conducted by mail ballot were ratified.

Reports were submitted by the American officers of the sections of the International Geodetic and Geophysical Union describing the progress made in the organization of these international sections. A report was submitted from the acting executive committee covering the work of preparation for the annual meeting.

A brief exposition was given of the status and functions of the American Geophysical Union, on the one hand, in relation to the parent bodies, the International Research Council, the National Research Council and the International Geodetic and Geophysical Union, and on the other, in relation to the branches of science embraced under the term "geophysics" and specifically included in the sections of the union.

For each of the sections addresses were made by the chairman, setting forth in outline various problems of interest to the sections. These addresses constituted brief surveys of the research needs of the various branches of geophysics. They will be prepared for publication and issued at a later date.

Officers were elected to serve from July 1, 1920, as follows: American Geophysical Union: *Chairman,* Wm. Bowie for two years; *Vice-chairman,* L. A. Bauer, for two years; *Secretary,* H. O. Wood, for three years; Section (*a*), Geodesy; *Chairman,* Wm. Bowie, for two years; *Vice-chairman,* J. F. Hayford, for two years; *Secretary,* H O. Wood, for three years; Section (*b*), Seismology; *Chairman,* H. F. Reid, for two years; *Vice-chairman,* J. C. Branner, for two years; *Secretary,* H. O. Wood, for three years; Section (*c*), Meteorology, *Chairman,* C. F. Marvin, for two years; *Vice-chairman,* W. J. Humphreys, for two years; *Secretary,* A. J. Henry, for three years; Section (*d*), Terrestrial Magnetism and Electricity, *Chairman,* L. A. Bauer, for two years; *Vice-chairman,* W. F. G. Swann, for two years; *Secretary,* J. A. Fleming, for three years; Section (*e*), Physical Oceanography; *Chairman,* G. W. Littlehales, for two years; *Vice-chairman,* tie vote, no election; *Secretary,* J. T. Watkins, for three years; Section (*f*) Volcanology; *Chairman,* H. W. Washington, for two years; *Vice-chairman,* R. A. Daly, for two years; *Secretary,* H. O. Wood, for three years.

HARRY O. WOOD,
Secretary

THE NATIONAL ACADEMY OF SCIENCES

THE program of the scientific sessions of the annual meeting, held in Washington on April 26 and 27, was as follows:

MONDAY, APRIL 26

Morning Session

Conservation of natural resources as a proper function of the National Academy: JOHN M. CLARKE.

On the rate of growth of the population of the United States since 1790 and its mathematical expression: RAYMOND PEARL.

Growth and development as determined by environmental influences: FRANZ BOAS.